

REMARKS/ARGUMENTS

Applicant responds herein to the Office Action dated February 27, 2004. A Petition for Extension of Time (one month) and the fee therefor are enclosed.

The Office Action reiterates the rejection of claims 1-20 and 28-43 under 35 U.S.C. §102(e) as being anticipated by Nedic, et al. (6,563,841). As noted in the Office Action, that rejection can be overcome by a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application, and thus is not an invention "by another," or be an appropriate showing under 37 CFR 1.131.

Accordingly, a self-explanatory Declaration under 1.132 is enclosed, which is believed and respectfully submitted to overcome the rejection of the claims over the prior patent to the instant invention, namely over patent 6,563,841.

The applicant also encloses a brief dissertation on Discrete Fourier Transforms (of a particular type).

Claims 21-27 and 44-50 stand rejected on grounds of obviousness over Harikumar, et al. (6,631,175), in view of Ono, et al. (6,302,576). Reconsideration is requested in view of the following remarks.

Preliminarily, a difference between the present invention and the prior art (such as the previous Nedic reference) is not the mere use of MLSE.

The present invention, rather, deals with how to compensate for the per-bin distortion that comes with PRS-based windowing applied in a DMT system. To do this, it takes advantage of some of the well-known benefits of MLSE in single carrier transmission scenarios and applies trellis/Viterbi type decoding along the frequency axis for each DMT symbol independently. The present invention, strictly speaking, does not depend on a particular equalization method (although it will benefit greatly from using the equalization method set forth in the previous Nedic patent).

Turning to the rejection of claims 21-27 and 44-50 on grounds of obviousness over Harikumar, in view of Ono, it is noted that claims 21 and 44 are independent. The text of these two claims is set forth below.

21. A receiver circuit for providing a decoded output from a received discrete multi-tone modulated input signal, the input signal being received from a communication channel having noise thereon, the input signal comprising digital data, the circuit comprising:

a first stage having a frequency response for applying a discrete Fourier transform to the input signal; and

a second stage for receiving an output signal from said first stage and per-bin decoding said signal based on a maximum likelihood sequence estimation (MLSE) algorithm so as to recover said digital data;

wherein said maximum likelihood sequence estimation (MLSE) algorithm includes a calculation of state metrics and is modified to include subtraction of estimated noise samples using noise prediction coefficients.

44. A method in a receiver circuit for providing a decoded output from a received discrete multi-tone modulated input signal, the input signal being received from a communication channel having noise thereon, the input signal comprising digital data, the method comprising the steps of:

applying a discrete Fourier transform to the input signal; and then

per-bin decoding said signal based on a maximum likelihood sequence estimation algorithm so as to recover said digital data;

wherein said maximum likelihood sequence estimation (MLSE) algorithm includes a calculation of state metrics and is modified to include subtraction of estimated noise samples using noise prediction coefficients.

As set forth above, these claims are directly related to a receiver circuit. Per claim 21, the receiver circuit provides a decoded output from a received discrete multi-tone modulated input signal. Claim 21 includes a first stage that has a frequency response for applying a discrete Fourier transform to the input signal. A second component of claim 21 is a second stage which receives the output signal from the first stage and per-bin decodes that signal based on MLSE, in order to recover the digital data. Significantly, the MLSE algorithm “includes a calculation of state metrics and is modified to include subtraction of estimated noise samples using noise prediction coefficients.” Claim 44 is merely the “method” version of claim 21.

The Office Action relies on the primary Harikumar reference virtually exclusively to show the use of a discrete Fourier transform (DFT) to decode the received digital signal, referring the applicant to element 120 -- the DFT -- in Figure 1. But the Office Action concedes that this primary reference “...does not disclose using maximum likelihood sequence estimation (MSLE) (sic) algorithm to recover the received data.”

Accordingly, the Office Action turns to Ono for the proposition that it discloses using MLSE, adding that “...the MLSE unit calculates metrics corresponding to a transmitted symbol sequence estimated by an adaptive equalizer (abstract). The adaptive equalizer is a MLSE equalizer (column 1, lines 41-45).” The Office Action then concludes that the MLSE equalizer being described: “...passes a received and digitized signal through a matched filter which minimizes the influence of noise by changing the characteristics thereof in accordance with the transmission path characteristics of the most likely transmitted symbol sequences estimated from the output of the matched filter...”. As such, the Office Action reasons, the noise components are subtracted. Finally, the Office Action urges that it would have been obvious for one of ordinary skill in the art to utilize the teachings of Ono in the decoder of Harikumar.

The applicant respectfully traverses the Office Action assertions on several grounds. Claims 21 and 44 speak of a first stage which applies the discrete Fourier transform and a second stage which receives the output of the discrete Fourier transform (the first stage) to carry the per-bin decoding using MLSE. To begin with, neither reference being cited teaches that arrangement.

Secondly, in accordance with claims 21 (and 44), the MLSE algorithm itself is modified to include subtraction of noise samples using noise prediction coefficients.

To fully appreciate the distinction over the prior art, note that in the instant specification, beginning at page 9, the MLSE decoding is described. Thereafter, beginning at page 15 under a heading: “Noise Cancellation”, reference is made to an important part of the present invention which specifically modifies the MLSE through the utilization of various noise prediction coefficients therein.

In the Ono reference, metric calculations are described relative to the element 8 in Figure 1, which is broken into various components thereof in Figure 2. Applicant has found nothing in Ono’s description of the MLSE estimation unit concerning noise. Indeed, the term “prediction” appears nowhere in the Ono reference. There is nothing - not a single word - concerning “noise prediction coefficients” anywhere in this reference.

Indeed, the first instance in the description where “noise” is mentioned, is at column 8, line 45, where reference is made to Figure 7 and low pass filter 35 which, as the Examiner will

readily ascertain, appears prior to the analog to digital converter 36 and the MLSE estimation unit 37. The word "noise" is next mentioned at column 9, line 25, relative to matched filter 23, which is shown in Figure 5. Regardless, these noise filters are not part of the MLSE proper and nothing is said concerning "noise prediction coefficients" in the MLSE, as specifically called for in independent claims 21 and 44. Furthermore, at column 11, lines 5-15, it is specifically stated that since the matched filter 23 minimizes the influence of noise, it is preferable to estimate the signal after the match filter 23, rather than before the same. In other words, MLSE is performed after filtering.

For all of the foregoing reasons, it is respectfully submitted that the Office Action has not made out a prima facie case of obviousness relative to claims 21-27 and 44-50 on the basis of the cited references, Harikumar and Ono.

Accordingly, the Examiner is respectfully requested to reconsider the application, allow the claims and pass this case to issue.

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as First Class Mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on June 28, 2004

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Respectfully submitted,

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